Current Status of Resources in the Grand Canyon

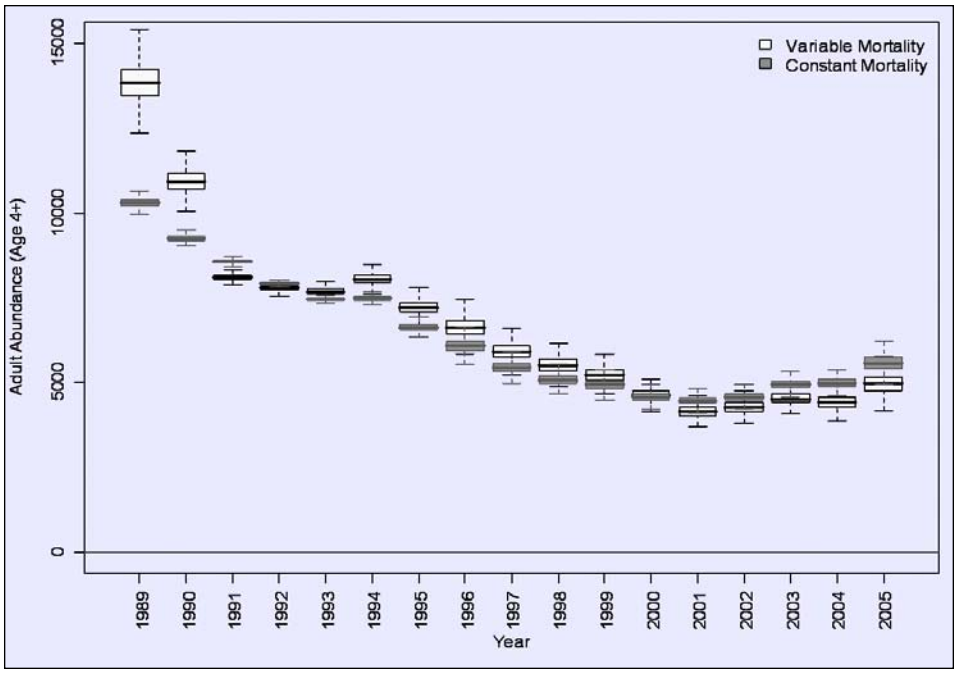
The Glen Canyon Dam Adaptive Management Program was established to monitor and analyze the effects of dam operations on downstream resources and to use these assessments to recommend to the Secretary of the Interior adjustments intended to improve the values for which the Glen Canyon National Recreation Area and Grand Canyon National Park was established.

Recent fieldwork - conducted cooperatively by the U.S. Geological Survey's Grand Canyon Monitoring and Research Center (GCMRC), the Arizona Game and Fish Department and the U.S. Fish and Wildlife Service and others - indicate that the state of the natural and biological resources and habitat downstream of Glen Canyon Dam may be stabilizing and/or in some cases improving.

Grand Canyon Humpback Chub Population Stabilizing

Recently collected data by scientists affiliated with the U.S. Geological Survey's Grand Canyon Monitoring and Research Center (GCMRC) indicate that the number of adult (age 4+) humpback chub in Grand Canyon stabilized between 2001 and 2005 after more than a decade of decline.

Between 2001 and 2005, however, habitat conditions appear to have improved and the number of adult fish stabilized at an estimated 5,000 fish. Additionally, near the confluence of the Colorado and Little Colorado Rivers, catch-rate data from the monitoring program indicate an increased abundance of juvenile humpback chub between 2003 and 2005. The increased numbers of juvenile humpback chub appear to directly correlate with the warmer water releases that have occurred from Lake Powell as a result of the extended drought and lower reservoir conditions.



ASMR Models of GC Adult (4+ yrs.) HBC Population through 2005. ***Source Data: U.S. Geological Survey***

Catch rates for humpback chub in 2005 were higher than previous years in middle and lower Marble Canyon (U.S. Geological Survey, unpub. data, 2006). Higher than average catch rates at these locations were unexpected because they are up to 25 river miles above the confluence of the Colorado and Little Colorado Rivers where spawning usually occurs. These

findings suggest that more favorable conditions for spawning and incubation existed in the Colorado River main channel during 2005. Adult (age-4+) humpback chub population estimates (1989-2005) for the Little Colorado River. Upper and lower bounds are 95 percent Bayesian credible intervals. When confidence intervals are considered, the model indicates that the population has stabilized.

Positive Indicators from Fish Suppression Activities

The exact causes of the stabilization of the adult population and increased numbers of young humpback chub cannot be specified at this time. However, humpback chub in Grand Canyon may have benefited from several changes, including the experimental removal of nonnative fish, experimental water releases, and drought-induced warming.

Beginning in 2003, large numbers of rainbow trout (Oncorhynchus mykiss) and brown trout (Salmo trutta) were removed from the area near the confluence of the Colorado and Little Colorado Rivers. Rainbow and brown trout are thought to compete with humpback chub for food and are known to prey on young humpback chub. Between 2003 and 2006, the rainbow trout population in the Colorado River near the Little Colorado River has been reduced by more than 60 percent. Discontinuation of the suppression activities in 2007 will allow scientists to study and better understand whether there is a direct connection between reduced predators and stabilizing humpback chub populations.

Positive Impacts from In-stream Warming Conditions

Humpback chub produced in 1999 may also have benefited from substantial in-stream warming as the result of the 2000 low summer steady flow experiment. The experiment held Glen Canyon Dam releases constant at 8,000 cubic feet per second from June through August 2000 and included two habitat maintenance flows (high, steady dam releases). As a result, in the summer of 2000, peak water temperatures in some parts of Grand Canyon exceeded 20ºC (68.5ºF), which represents a temperature increase when compared with typical peak temperatures of 15-18ºC (59-64ºF) in recent years. Humpback chub habitat may also have been improved as the result of experimental floods conducted in 1996, 1997, 2000, and 2004.

Since 2003, water temperatures below the dam have also increased as the result of drought conditions. As drought has reduced flows into Lake Powell, the level of the reservoir has dropped, allowing warmer water found closer to the surface of the reservoir to reach the release structures. In Summer 2005, water temperatures in the mainstem Colorado River near the Little Colorado River exceeded 17ºC (60.8ºF), the warmest temperatures recorded since the reservoir filled in 1980 and above the minimum temperature needed by humpback chub to successfully reproduce.

Scientists are not yet able to determine the relative importance of the various factors that may be contributing to recent improvements. More work will be required to understand how nonnative fish, temperature, and the operation of Glen Canyon Dam interact to affect the humpback chub population in Grand Canyon.

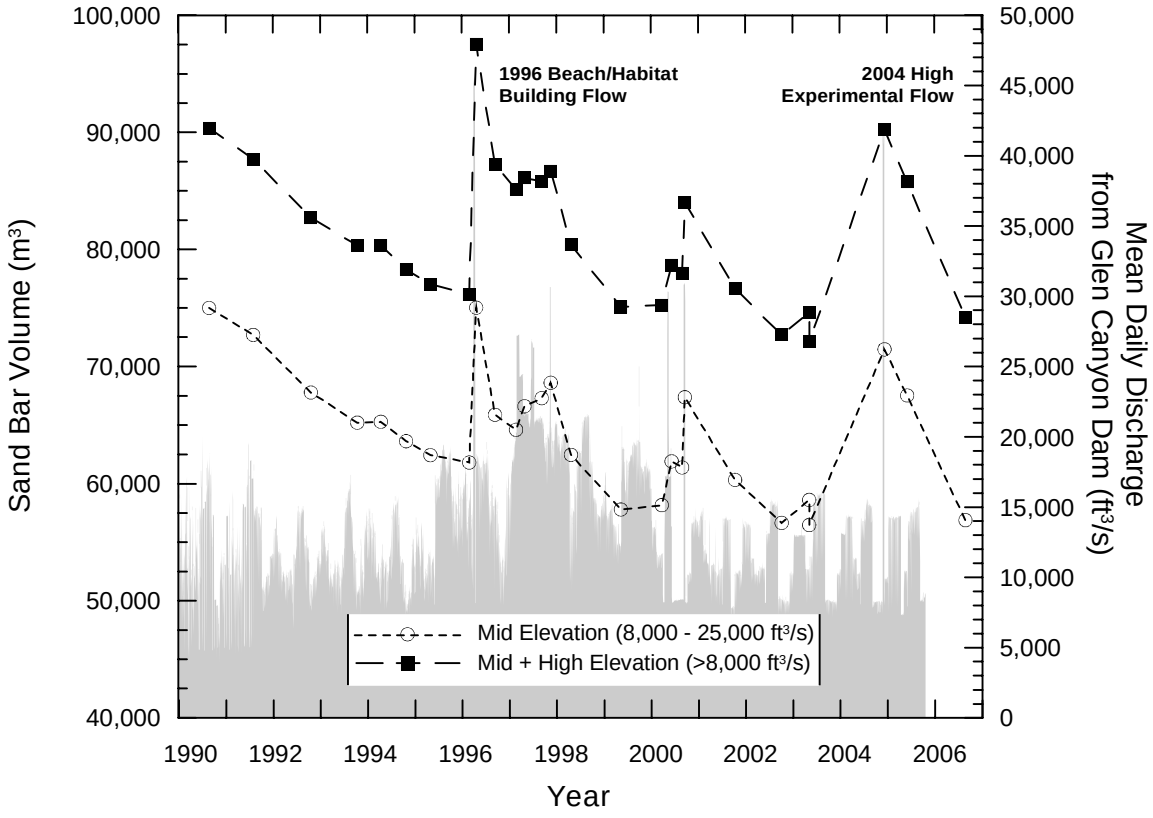
Increased Sediment Retention - Results from the 2004 Beach Habitat Building Flows

Results from the 2004 controlled-flood experiment indicate that substantial increases in total eddy sandbar area and volume in the Colorado River in Marble and Grand Canyons are an outcome of controlled floods conducted under the sediment-enriched conditions that follow large tributary floods.

Under the lower dam releases that preceded the 2004 beach habitat building flows, most of the new tributary-supplied sand was retained in the uppermost part of Marble Canyon. During the 2004 experiment, this sand was eroded from the channel bed and transported downstream, with a fraction transferred into eddies. This resulted in a net increase in the total area and volume of eddy sandbars in the upstream half of Marble Canyon.

In addition, about half of the sandbars surveyed in this reach following the 2004 experiment were substantially larger at higher elevations than they were following the 1996 test. Downstream reaches were not as enriched with new tributary-supplied sand. In comparison, the previous high-flow test at the dam in 1996 was designed to stir up and redistribute sediment from the bottom of the Colorado River and add it to river banks. The hypothesis underlying that test was not borne out by the results, leading scientists to believe that the more effective approach would be to redistribute tributary sediment.

In total, the net mass balance for sand during the 2004 experiment was actually positive system-wide, despite depleted conditions below Marble Canyon. Scientists believe that sand bar restoration will likely require additional high flow tests timed in combination with new sand from tributaries. Based on findings from the 2004 experiments, frequent short-duration controlled floods under sand-enriched conditions could result in enrichment into the downstream half of Marble Canyon and gains in total eddy-sandbar area into the Grand Canyon.



Total Sand Bar Volume at 12 Sites in Marble Canyon through Oct 2006 Source Data: Northern Arizona University